3: Robequain--260 S-5 (no date) 1944 Laotians
116, 135, 316, 439, 471

"For the past several years the production of tin in the Nam Patène basin in Laos has exceeded that at Pia Ouac. The Nam Patène River is a left hand tributary of the Nam Hin Boun, which itself flows into the Mekong at Pak Hin Boun, north of Thakhek. Cassiterite has been mined here from time immemorial by the Laotians who dug small shafts a few meters deep into the alluvium. Native mining continues today on the European concessions, the ore being purchased by the companies. Formerly, after careful sorting, the richest particles were crushed, washed in cradles and reduced in Chinese charcoal-furnaces. But about 1920 production was still a mere ten to fifteen tons a year; it was exported to Thailand where it was used only as ballast for fish nets."

3: Robequain--260-261 S-5 (no date) 1944 Laotians
116, 135, 316, 471

"It was not until 1923 that the Société d'Études et d'Exploitations Minières de l'Indochine began to work the beds systematically. Veins had first been discovered in the eluvium and alluvium of a huge karstic basin some 30 kilometers long and 8 wide, cut into the Urals-Permian limestone which dominates it with dramatic masses and sheer, almost insurmountable slopes. The eluvial cassiterite is joined in depth to the veins which pass through the Muscovitic sandstone subjacent to the limestone, and which have been metamorphized by granite intrusions. Here it is not associated with wolfram as it is in Pia Ouac. It is about ten meters thick with a thin covering of unproductive soil; mining is quite easily performed by the open-pit method, under a 'cai's' direction. Almost all the ore extracted up to the present has come from the Phon Tiou bed on the Solange grant. The 1926-1929 boom brought about the formation of other companies whose grants are worked by the Compagnie Fermière des Étains d'Extrême-Orient. Production started in 1933 and is carried [261] on around Boneng. They have begun cutting out the veins, whose reddish chimneys stand out between their white sand-stone wells."

3: Robequain--261 S-5 (no date) 1944 Laotians
116, 135, 316, 402, 494

"Laos ore is harder to work than Tonkinese because of its lower metal content and the presence of considerable amounts of sulphurous and ferruginous matter. In addition, coal is scarce here: producer gas gazogenes run the dynamos which produce motive power, but they consume enormous quantities of wood, which must be cut farther and farther away from the mine. As a result, the ore has never been smelted on the spot. But mechanical processes for separating and purifying have gradually been set up at the mines. For example, after crushing and magnetic separation, very well-equipped washers prepare concentrates for export. Under sloping roofs, powerful machines stand in tiers one above another on the hillsides, so that the water and the gradually purified product itself are moved as much as possible by mere gravity from one process to another. The mud and rocks, which were dumped out of small wagons at the top of the mill, appear as black cassiterite crystals at the bottom where they fill little 35 or 50 kilogram sacks for shipment to Singapore. They are transported either via the Mekong or over the roads from Thakhek and Savannakhet to the Annam coast. Six thousand Annamites work in the tin mines of the Laos basin; though a few are Tonkinese most of them come from Nghê Tinh. Work is done by gangs and goes on continuously since the machines can be stopped only at great expense; at night this isolated basin, surrounded by rugged mountains and dotted with electric lights which furnish illumination for the coolies as they work to the accompaniment of the mills' unrelenting rhythm, is a striking picture."

3: Robequain--262 S-5 (no date) 1944 Laotians
116, 135, 316, 439

"More or less argentiferous lead ores are found together with zinc ores in most beds, and it was these for which the Chinese sought particularly. French companies have attempted to reopen the mines, particularly that at Ngan Son south of Pia Ouac, but without success. The Compagnie Minière et Métallurgique de l'Indochine exports a few tons of lead ore and some tens of kilograms of silver, mere by-products of the company's zinc mining."

10: d'Orleans--325 T-3 (1891-92) 1894 Laos
116, 316, 346, 532, 821

[LSS: in Luang Prabang] "When we land on the left bank, we notice a number of people stooping down, with their feet in the water, engaged in washing out the sand; these are gold finders, who earn but a scanty living, though they sometimes come upon an old coin or two which has been washed down stream. A climb of about fifty feet up decrepit steps, which in summer are under water, brings us to the town. Close upon the left is a small pagoda, Ouate Poune Saï, which is only remarkable for the fresco above the entrance gate, this representing Kop, the sun, eating the moon; in other words, the fresco is intended to designate an eclipse."

10: d'Orleans--357-358 T-3 (1891-92) 1894 Laos
116, 135, 316

"There is a great deal of mineral wealth, in the Laos country, and among the many gold fields which might be worked to advantage are Pac Bay (above Luang Prabang), Xieng Mang, and Xieng Mon. There is an abundance of antimony, lead, copper, and iron, while there are agates and chalcedonies near Luang Prabang. Then, [358] in the neighbourhood of Kiangsen, there is a ruby mine belonging to the king of Nan, which is not yet worked, though a Burmese has applied for a concession."

rocks which tower precipitously over its course, the Sé-Kémane widens out as it is joined by the Dak-Bla, the sources of which, like those of its chief tributary the Sé-Souk, are near the Sésane. The Sé-Kémane is hardly navigable for pirogues except from Muong-Kao on. The latter is the most important center in the region and is generally known by the name of Attopeu. Pirogues can ply back and forth between this point and Stung-Treng in all seasons, but the many rapids with which the Sékhong is encumbered, mainly as far as the Sé-Pien, make its course extremely torrential and navigation very difficult. Before it reaches Siempang the Sékhong is joined on its right bank by the Sé-Pien which, like its [102] tributary the Sé-Kampho, comes from the plateau of the Bolovens. When they leave their gorges these two rivers water marvelous plains which are slightly hilly towards the north and which could serve as pasture land for immense flocks. From Siempang on the Sékhong can be navigated by steam launches during the high water period.

Before it reaches the Mékong the Sékhong is joined, less than ten kilometers from its mouth, by its chief tributary the Sésane, which with its 400-kilometer course is of no less importance and interest than the Sékhong itself.

The Sésane comes from a mountain mass which dominates the amphitheater of Cong-Bol just above the 15th parallel. Its deep valley is called Poco by the natives. Like all the upper valleys of the watercourses in this region, it is encumbered with rapids and waterfalls and deeply cut between rock walls. On its left bank the Poco is joined by the Bla, the valley of which is followed for some distance by the road joining Attopeu to Qui-Nhon by way of Kon-Toum. The Sésane then traverses all this gold-bearing region which is still little-known and, so to speak, unexploited to this day. In its valley are found the mining posts of Ban-Phi, Ruhleville and Bokham. It can be navigated by pirogue in all seasons from Kong-Sédam on. The latter point, slightly above Ban-Phi, has a militia post stationed there to provide security for the works of the Attopeu Gold Mining Company [compagnie des Mines d'or d'Attopeu].

Some twenty-five kilometers from its mouth the Sésane is joined by the Ton-Lé-Srépok, a large tributary. This river, also known as the Sé-Bang-Khan, comes from the south, not far from the plateau of Lang-Bian. It passes close by Darlac, the capital of the province of the same name, and through Ban-Don, from which point it is

505
133 navigable during part of the year.

The Ia-Drang, whose valley is inhabited by the Djaraï tribe, is one of its principal tributaries. For that matter, the most important Kha tribes are settled in the valleys of the watercourses which have been dealt with in the foregoing. Thus we find the Lové Khas between the Sé-Khong, the Sé-Souk and the Sésane; the Niaheun Khas and a few Alaks in the valley of the Sékhong; the Souk Khas in those of the Sé-Pien, [103] [Illustration] [104] [Blank page] [105] the Sé-Kampho and the lower Sékhong; the Salangs between the Sésane and the Sé-Souk; the Bahnars and the Rognaos in those of the Bla and the other left-bank tributaries of the Poco; the Penongs in the deep valley of the Srépok; the Djaraïs in the middle valley of the Sésane and in that of the Ia-Drang; and the Braos and the Tiam-Poueun in the lower Sésane. Those [Illustration here] of the Kha tribes which have been pacified work the gold-bearing alluvia of these rivers and pay their taxes with the gold dust which they extract.

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316

Upriver from Stung-Treng and as far as the waterfalls the Mékong can be navigated at low water by steam launches. At high water the large steamers of the Cochinchina River Merchant Fleet [Messageries fluviales de Cochinchine] which provide service between Saigon and Pnom-Penh can go up as far as Khône. Below Stung-Treng and as far as Kratié the river can be navigated only by pirogues at low water. The following table [106] shows the average length of journeys by river between Stung-Treng and nearby points on this reach:

Kha

result. But the Kha ideal is to possess a battery of gongs of different sizes and timbres, and with these they manage to obtain quite perfect chords.

Industry. Withdrawn in their mountains where they live in small isolated groups, the Khas use their leisure time to make many basket-work and hollow-ware products which have a mark of elegance and a great deal of delicacy. Other tribes make paper from wood pulp, weave mats from rattan and bamboo bark, etc. They use all these products in trade.

Finally, certain Khas exploit deposits of iron ore and transform it into farming implements, while others wash gold-bearing sands.

In general, although the Khas are industrious they work only to procure what is strictly indispensable. They cannot resign themselves to staying away from home for any length of time and dread any stay in the low country, which they say is unhealthy for them. Since they have particular aptitudes for woodcutting, however, they have been successfully employed to cut teak wood in the forests on the right bank of the Mekong which are situated in Siamese territory. But it must be admitted that there they are in mountainous country and in the midst of forests, as in their native region.

The Khas of southern Laos. In southern Laos Khas are found who differ very little from those of Upper Laos. We shall not concern ourselves with them, but shall deal briefly with the many more numerous ones who have particular mores and customs.

The Djarais, the Rades, the Bahnars, the Cedangs, the Peunongs, the Rognaos (1), etc. are the principal types of these Kha tribes,

(1) See Appendix XVIII.

which for the most part are still independent.

These people are proud, large and muscular, supple, trained in all forms of bodily exercise, bold, warlike and brave.

These qualities, moreover, have been developed by their peculiar way of [257] [Illustration] [258] [Blank page] [259] life. Accustomed to hunting slaves from which they extracted large profits by selling them on the banks of the Mekong, these Khas have had to resort to continual expeditions in order to obtain their human game.

For many long years, in fact, they could acquire [Illustration here] the gongs, buffalo, metals, textiles, etc. which they needed only by selling captives, generally Annamites, whom they went and

135 by the destruction, pulverization and washing of their gangues, all these metal particles were deposited, merely by virtue of their density, in nearby beds and on the least inclined planes along the courses of the waters in which they were contained.

Moreover, because the soil of Laos has long been stable we find the mineral deposits covered with a comparatively shallow layer of sterile alluvia. Sometimes this layer is practically nonexistent, and it is always easy and inexpensive to work. In some points the lode-bearing deposits are even on the surface or only just below the alluvial deposits.

The list which follows will give some idea of the extensive mineral wealth in Laos. Because of a lack of means of communication and mechanical equipment, however, the exploitation of its forest, animal and vegetable resources will be delayed for some time. But although one might hesitate to come to Laos in order to experiment with the rich crops which would be suited to its warm, damp climate and its virgin soil, we believe that the exploitation of its mineral deposits is of such a nature as to tempt French capitalists who, if they operate prudently, can be assured of reaping rich rewards in a short length of time for their effort and their initiative.

316 Here is an enumeration of the mineral wealth of Laos, based on the most recent information.

1. Gold Mines

A. Deposits of Nam-Beng and Nam-Ngao (province of Luang-Prabang).	Prospected in 1895 by Mallet and Isnard, engineers.
B. Deposits of Nam-Poun, (Outhai-Thani, Luang-Prabang, right bank).	Goldbearing gravel prospected in 1899 by M. Macey, government commissioner.
[316] C. Deposits of Tran-Ninh.	Prospected in 1895 by a private company.
D. Deposits of Ban-Tong-Ak (Upper Nam-Teun, province of Cammon) and of Vang-Kham (same province)	Deposits noted but not yet prospected.

316

E. Deposits of the Nam-Kok (tributary of the Se-Bang-Hien, province of Song-Khone).	Goldbearing gravel noted, but not yet prospected.
F. Deposits of Muong-Son (Nam-Het, province of the Hua-Pahn).	Prospected by M. Macey, government commissioner.
G. Deposits of Vien-Tiane, Nong-Khay (Nam-Ngum, Nam-Tone, Nam-Sang, Nam-Sone).	Goldbearing gravel noted, but not yet prospected.
H. Deposits of the region of Attopeu.	Concession given to the Attopeu Goldmining Company [Société des mines d'or d'Attopeu].
I. Deposits of Bokham (province of Stung-Treng).	Prospected in 1894 by the Pelletier mission.
J. Deposits of Ban-Phi (province of Stung-Treng).	Concession given to the Attopeu Goldmining Company.

2. Tin Mines

Deposits in the valley of the Nam-Pa-Then (province of Cammon).	Concession for these deposits given to the Hin-Boun Tin Company [Société anonyme des étains du Hin-Boun]. These mines are worked by natives and supply all the tin used in the land.

3. Copper Mines

A. Deposits of Tia-Vit (province of Saravane).	Deposits noted, but not yet prospected.
B. Deposits of the Se-Done (Kham-Thong-Niai, province of Saravane).	

149: Reinach—233 G-3 (no date) 1901 AM1 Indochina
Laotians AM8

316

C. Deposits of the Pou-Thong (province of Ban-Mouang).

D. Deposits of the Upper Nam-Beng (province of Luang-Prabang).

} Deposits noted, but not yet prospected.

E. Deposits of the Nam-Katang (province of Cammon).

F. Deposits of the Sekhong (across from Pak-Hoi, province of Attopeu).

} Deposits prospected, but not yet being worked.

[317]

4. Lead Mines

A. Deposits of Ban-Memo. Silver-bearing galena (province of Attopeu).

B. Deposits of the Houe-Palai. Galena (province of Ban-Mouang).

} Deposits noted, but not yet prospected.

C. Deposits at several points (province of Luang-Prabang).

D. Deposits at several points (province of the Hua-Pahn).

} Exploited by the natives.

5. Iron Mines

There are iron deposits at several points in the provinces of Luang-Prabang, Vien-Tiane, Cammon, Tran-Ninh and the Hua-Pahn, and among the Cedangs. Some of these are worked by the natives.

316

6. Coal mines

Deposits have been noted along the Sekhong and in the provinces of Luang-Prabang and Muong-Hou.

7. Antimony Mines

There are deposits of antimonious galena in the provinces of Vien-Tiane, Luang-Prabang and Darlac (Puong region).

8. Sulphur Mines

The natives extract sulphur at several points in the provinces of Luang-Prabang and the Hua-Pahn.

9. Saltpeter Mines

The natives obtain saltpeter in the provinces of Vien-Tiane and Luang-Prabang.

10. Alum Mines

There are several unworked deposits in the province of Song-Khone, particularly at Pou-Hin-Soun (mountain of alum) near Muong Vang-Kham.

11. Rock Salt Mines

The natives work several rock salt mines in the provinces of Song-Khone, Attopeu, Vien-Tiane, Luang-Prabang and Poukha.

12. Precious Stone Mines

A. In the north of the province of Khong (Pou-Nafang).	Deposits noted, but not yet prospected.
[318]B. Deposits in the region of Xieng-Khong (left bank) (1).	Deposits of sapphires and rubies worked by the Burmese. Prospected in 1895.

(1) A company is shortly to be formed in France for the exploitation of these deposits.

13. Sources of Sulphur

316 Sources of sulphur have been noted in the provinces of Cammon, Saravane and Darlac.

As a supplement to this list, the reader is referred to Appendix XXI, in which several goldbearing deposits are noted which have been prospected, but for which concessions have not yet been granted and which are not being worked by any European enterprise. We shall now continue with a consideration of the conditions under which various other deposits, such as iron and salt, occur.

Iron. The various iron deposits which exist in Laos are alluvial deposits caused by the erosion of rocks under the action of rain water and water courses. They occur sometimes in hills from two to three hundred meters high, and sometimes in hillocks of a lesser height which do not exceed fifty or sixty meters.

The ore is found scattered throughout the mass of reddish clay alluvia, in flint nodules and isolated blocks of small dimensions. The richest ores are formed of irregular masses of a reddish cellular rock somewhat similar to millstone rock, but softer.

The ore is extracted in furnaces provided with alternating blowers. These are first loaded with a layer of crushed and washed ore, then a layer of charcoal, and the layers are thus repeated several times. When the process has been completed a bloom of spongy iron is left at the bottom of the furnace, and this iron is reheated and puddled. When the molten mass is sufficiently homogeneous, blacksmiths take it and transform it into farming implements--axes, machetes, etc.--all of which are sold locally.

[326] [439] Production from the iron deposits in Laos is not sufficient for the needs of local consumption, since [319] [Illustration] [320] [Blank page] [321] iron is imported from Europe in small bars and sold for from 1 franc 30 centimes to 1 franc 50 centimes per kilogram.

It is unlikely that the country's iron deposits, at least those which have so far been discovered, will ever justify exploitation by European methods, because of their insufficient size.

317 Salt. The same is true in the case of salt, and the country's production is insufficient for local consumption.

The salt mines or, to use the proper term, saltbearing deposits are of three different kinds:

317

1. Layers of rock salt located in the center of mountain masses and through which infiltration water seeps. When this water reaches the bottoms of the valleys, it is held there by the first layer of impermeable terrain which it encounters. It is brought to the surface through wells, and the salt which it contains is extracted by evaporation. This procedure can be carried out during only a few months of the year, after the greater part of the rain water has run off.

2. Here we have the same type of salt formation as the above, but seepage of saline water takes place along a hillside or over rocks exposed to the open air. The saturated water impregnates the soil and becomes partly crystallized there or forms saline efflorescences on the surface. In the first case, the soil is washed and the wash water evaporated. In the second, the saline efflorescences are collected and mixed with the salt which has been extracted from the soil by washing.

3. Lastly, other deposits seem to be constituted by old sandy bottoms of saline lakes. During the rainy season ground water becomes saturated through contact with the layer of saltbearing sand and is extracted through wells and then evaporated.

b) Mining Companies

316

Instead of going to nourish foreign enterprises which are often hazardous, French capital should, as we have already noted, encourage the exploitation of the mineral deposits in Laos.

We ought to set to work resolutely and begin by [322] working the gold mines. We might hope thereby to obtain a large immediate profit, even in the country's present state of development, and with no need for better means of communication.

Plans and even studies are being made, moreover, towards the economic equipment of Laos as regards more rapid transport facilities, both in the interior and between the Mekong and the coast.

Other mineral deposits will very probably be discovered along with the gold mines, as has been the case in Attopeu, and they may begin to be worked when the network of roads and means of communication has been completed, or even partly so. Other enterprises, such as the exploitation of forest resources, livestock breeding, farming, etc. will follow as the country becomes better known.

At the present time two French mining companies have been formed in Laos, one to work the gold and copper in the region of

Attopeu, and the other to work the tin mines of the Nam-Hin-Boun. 316

1. Gold and Copper

The goldbearing deposits in the region of Attopeu have been known to the natives for many years. In fact, the natives have long paid their taxes in gold dust (1) obtained by washing sand.

(1) Here are the prices of native gold in nuggets and dust in the different goldbearing regions of Laos:

Luang-Prabang.....	1930 to 2760	francs	per kilogram.
Pak-Lay.....	2900 to 3005	"	"
Vien-Tiane.....	2750 to 2900	"	"
Attopeu.....	2060	"	"

Realizing the goldbearing wealth of this region, M. Rulhe succeeded in forming a "Joint Stock Company for the study of the Attopeu Mines" ["Société anonyme d'études des mines d'Attopeu"], with a capital of 250,000 francs. By a decree of the Governor General of Indo-China of August 6, 1895, this company was granted the following areas of research:

1. The basin of the Se-Souk and its tributaries;

2. The basin of the right bank of the Se-Sane and its right-bank tributaries as far as the Nam-Satai, including the basin of this latter river.

[323] An exploratory mission was at once sent to the spot. The goldbearing deposits noted by M. Rulhe were found, and at the same time copper-bearing deposits were discovered, for the development of which the company obtained an exclusive franchise. By reason of these new concessions it was led to increase its capitalization to 450,000 francs. These modifications were ratified by a decree of the Governor General of Indo-China, under the date of September 10, 1896.

Thanks to the invaluable help of Lieutenant-colonel Tournier, who was then Superior Commandant in Lower Laos, a mission composed of Messrs. Lanergues and Barraud, prospectors for the company, discovered the presence of rich lodes of gold (1) in the region of

(1) Samples from these deposits contained gold which was frequently visible to the naked eye.

316

Ban-Phi. A decree dated August 31, 1897, granted further concessions which had been requested as a consequence of these discoveries.

In 1897 M. Bel, a mining engineer, made a complete exploration of the goldbearing region on behalf of the company.

The conclusions of his report are as follows:

"From the mineralogical point of view the eruptive region which extends east of the Attopeu meridian to the China Sea, at least between the 13th and 16th parallels, is a goldbearing zone which embraces a very large part of the Kha lands. In this zone the alluvial gold deposits have been worked since time immemorial by the natives, using methods which might well be improved on. Deposits of gold in seams had heretofore been unknown in the Kha territories, and our own mission inaugurated the period of discoveries of this type of deposits, which were already known and partially exploited in the Annamite territory. Will the seam deposits, still virgin of all exploitation, which have recently been discovered among the Kha peoples have a brilliant future? This is a question which only prophets can answer. But the fact of their existence is, in itself, an important basis on which we are at least justified in founding hopes" (2).

(2) Mission to central Indo-China. Lecture delivered on May 26, 1898, before the Society for Colonial and Maritime Studies by J. M. Bel.

In 1898 a mining post was established at Ban-Phi, and at the same time a detachment of native guards was sent there to protect the workshops. We are therefore justified in hoping that the undertaking will soon enter into a working phase at this point.

[324] 2. Tin

We have seen, in our listing of mineral wealth, that tin has been found at only one point in Laos, the valley of the Nam-Pa-Then (province of Cammon).

These deposits have long been known to the natives and worked by them, but with unsatisfactory methods. Their annual production, [Illustration here] according to Captain Gosselin, is only 1,200 kilograms which, at local prices, represents a value of 600 piasters

316 (1,500 francs). This sum is enough for those whose only purpose is to obtain, through trade, the clothing, utensils and food which they need. During the time of the Siamese occupation part of the taxes of the villages in the valley of the Nam-Pa-Then was paid in tin.

As a consequence of prospecting operations carried out in 1894 and 1895 by M. Ménager, a small syndicate was formed at Saigon. After it had [325] obtained a concession for these deposits from the General Government of Indo-China, the syndicate was transformed, in 1896, into a joint stock company with a temporary working capital of 130,000 francs. Several study missions have been sent out under the auspices of this company. Samples brought back by the missions have been analyzed by M. Thompson, a Paris chemical expert who, despite their somewhat exceptional composition, [Illustration here] found a sufficiently high tin content to justify working the mines. The ores consist of highly ferruginous alluvia.

The tin itself is in very small fragments in the form of cassiterite. A few other mineral elements, containing lead and arsenic, can easily be eliminated by the proper roasting and washing techniques.

A new mission is on the spot at the present time. It is directed by M. Schlogel, an engineer. Its first labors have shown that the deposits contain a high percentage of [326] workable ore, and that they cover a comparatively large area since they stretch over a distance of more than thirty kilometers.

In view of a permanent working arrangement now anticipated for 1901, the company has successively raised its capital to 210,000 and then to 250,000 francs, and is shortly to increase it further.

In addition to the engineer Schlogel who directs exploratory work and studies of deposits as well as the installation of trial workshops, the company employs two French clerks at the present time, one French chief miner, and several hundred native workers of all categories, particularly Annamite carpenters from the province of Vinh and mechanics and miners from Saigon, who are also Annamite.

Several shafts and galleries have been opened, and the samples collected justify the belief that the enterprise is destined to have a rapid and extensive development. Its trial factory will soon be in a position to produce several tons of metal regularly each month, and there is every hope that before very long the tin from Hin-Boun will hold an honorable place on the metal market.

The same company holds the concession for important copper deposits in the valley of the Nam-Katang, a small tributary of the

Se-Bang-Fai. But studies are not yet sufficiently advanced for us to be able to give any useful information. 316

We have nevertheless felt that we should mention these deposits, in order to establish the importance of all this part of Laos from the point of view of mineral wealth.

[327] [Illustration at top of page]

CHAPTER VII

I

SCAVENGING

We have seen that the inhabitants of Laos are apathetic and little inclined to work. They nevertheless find, although they go to scarcely any trouble, enough to supply their needs easily. 461 241

Indeed, with the exception of a few annual crops such as tobacco, cotton and indigo which are grown on the ever-renewed alluvia of the watercourses, the production of rice and of maize are the only occupations which require--and even then during a relatively short time--any degree of work or perseverance. We may mention the opium poppy, ramie, hemp and the mulberry tree merely as a reminder, for only a small part of the population devotes its time to these crops, which are still not at all extensive. [249]

Yet, it may be objected, the native has an easy life, dresses adequately, [328] lives in a house which is solid and comfortable from his point of view, has various tools and utensils, weapons, and sometimes even valuable cloth goods, jewels, etc. He spends money for celebrations and for offerings to the bonzes and pagodas. He pays taxes, he supports court costs which are often large with respect to the question at issue, and he is subject to the exactions of his mandarins to a greater or less degree. Finally, the commercial transactions of Laos involve quantities and sums which are quite high in comparison to the sparse population. 511 [438]

How are we to reconcile all these factors, and how is it that the Laotian, who produces so little with his labor, nevertheless has all he needs to get along on?

This is due to the fact that Laos is above all else a scavenging country. 314

who were disposed to follow them.

464 stitions and perhaps also the opposition of the mandarins who for
563 centuries have tried [516] to prevent any exodus towards the lands situated beyond the mountains, have in the long run made him a stay-at-home.

This industrious, intelligent and prolific people prefers to struggle
000 for life in agglomerations which are too dense, rather than emigrate in order to obtain a life of well-being and ease.

We should not, however, despair of ever seeing the Annamites spread into Laos and there provide a powerful force for repopulation and make the low plains which border the Mekong from Cammon to Cambodia bear fruit. It is up to us to destroy the legends, to reduce to nothingness the superstitions which have gained currency, and then to use our influence to bring an end to the ostracism in which Laos is held. Does it not belong today to the great Indo-Chinese family in which all the component peoples are French subjects in the same right?

On the day when the mandarins no longer sustain a fear of Laos and a dread of slavery among the Annamites, it will be possible to induc them to emigrate into the Mekong basin. The colonies already in existence, particularly at certain points in Cammon, will grow from that day on through the addition of newcomers. We must not deceive ourselves into thinking that such immigration will not take time, and so in order to meet our most pressing needs European colonies in Laos will have to appeal to laborers from the southern provinces of China and especially from the island of Hainan, that inexhaustible reservoir which has supplied coolies to several parts of the world for so many years.

But, it will be asked, is Laos ready to welcome colonists who want to work the mines and forests and to engage in trade, agriculture and livestock breeding? We believe that, in the present state of communications, some of these undertakings are possible at this moment and that others cannot hope to succeed until the country's economic equipment has developed.

• 316 As concerns commerce and the exploitation of forests and mines,
313 we have noted that several attempts have already been made. These are valuable indications showing the [517] courses which isolated
185 colonists or companies which would like to employ their capital in our new possession can follow as of the present time. Indeed, such undertakings yield profits almost from the very beginning, and if they are

316 begun at judiciously chosen points [Illustration here] they can be accommodated to the existing means of communication and transport
313 if necessary. As for the sums needed to engage in a commercial,
185 mining or forest enterprise, it is difficult to determine these in any precise fashion for, depending on the region and the special conditions of the terrain, such matters may require more or less capital.

[518] For dealing in teak wood (1), for example, the sums needed

(1) A rigorous investigation made by a chief guardsman of the Laotian militia of the region of Xieng-Khong, on the left bank of the Mekong, has shown that the number of teak trees ready for cutting in the province of Muong-Sing is 4,975 in all, 2,000 of which are of exceptional size for the region, that is to say that their diameter varies between 0.3 and 0.6 meter. Counting the young shoots and young trees, the total number of teaks which we possess in Muong-Sing may be estimated at about 20,000.

Another group is situated on the right bank of the Mekong, in the vicinity of Pak-Lay and in the basin of the Nam-Poun. It includes from 10,000 to 12,000 teak trees ready for cutting, concessions for about half of which have been granted. (Bulletin économique de l'Indo-Chine, 1900.)

for purchase and transport would depend on the quantity which it was desired to export. As an average indication, the sum of 40,000 francs might be given for operations on 1,000 teak trees.

From the point of view of mineral resources, certain deposits require capital in the millions for their exploitation, while others might be worked profitably with sums varying between 250,000 to 500,000 francs.

433 In the way of industries which may be started at the present time,
185 we may cite only the establishment of rice distilleries in southern Laos and of a mechanical sawmill at Khone.

[273 A distillery could be set up without any great expense at the
243] mouth of the Mekong and the Sedone, for example. Thanks to the price of glutinous rice which is five or six times less expensive in this region than at Pnom-Penh, the alcohol from such a distillery would find a certain market in Cambodia.

185 For several years now there has been talk of establishing a
313 mechanical sawmill on the island of Khone which would obtain its
439 motive power from the nearby waterfalls. Besides teak wood (2),

(2) Teak is generally regarded, although wrongly, as the wood

Kha

563 in a few particulars. They all inhabit the peaks of mountains, where they generally engage in the cultivation of poppies and maize.

[439 241] Hos. The Hos are genuine Chinese who came in with the caravans from Yunnan and settled in the land to engage in trade or to grow cotton (1).

(1) According to a monograph by Government Commissioner Grand.

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APPENDIX XVIII
NOTE ON THE EASTERN REGION OF LOWER LAOS (1)

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(1) Extract from a report by Colonel Tournier, Superior Commandant of Lower Laos. (Bulletin Economique de l'Indo-Chine, 1900, No. 19.)

PRESENT STATUS OF THE DIFFERENT KHA TRIBES

563 TRIBES LIVING ON THE GREAT ANNAMITIC CHAIN. 1. The tribe of Tha-Hoi may be regarded as being entirely pacified. It is a dependency of both Annam and Laos, but the spheres of influence of the two lands were perfectly delimited at the time of the establishment by Annam of the administrative post in Lao-Bao.

2. The Khon-Tou-Khas, the Ve-Khas and the Alak Khas are completely pacified and extremely tranquil. They are dependencies of Saravane.

Between the high valleys of the Se-Kemane and the Sesane (where the word Legnau, which is unknown in the region, is found on the Pavie map), there is an absolutely deserted region which serves as a buffer between the abovementioned tribes and the Cedangs.

[316] 563 567 3.The great tribe of the Cedangs, so far unconquerable. It occupies both sides of the chain, and its villages are situated in extremely difficult positions. The land is very poor, and until the last few years, besides the iron deposits which they work, their real commerce was the slave trade. All the Annamite slaves of the Mekong valley, both on the left bank and the right, came from raids made by these tribes in Annamite territory, even down as far as the sea. The abolition of slavery in Laos was a great blow to them, but since it is absolutely necessary for them to procure buffalo and oxen in order to live and especially for their superstitious practices, they still continue to make occasional captures in Annam and find a market for

149: Reinach--422 G-3 (no date) 1901 AM1 Indochina
Laotians AM8

[124]

APPENDIX XXI

NOTES ON GOLD-BEARING DEPOSITS

1. DEPOSITS OF NAM-BENG AND NAM-NGAO (District of Pak-Ta--Luang-Prabang)

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These deposits, which are situated in the principality of Luang-Prabang a hundred kilometers west of the capital, are made up of alluvial beds in the valleys formed by the left-bank tributaries of the Mekong (Nam-Beng, Nam-Ngao, Nam-Ta, etc.).

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Before our settlement in Laos, these deposits had long constituted part of the patrimony of the kings of Luang-Prabang. It was from here that they extracted all the gold needed not only to pay their tributes of vassaldom to the Chinese, Annamite and Siamese sovereigns, but also to make purchases in Bangkok and cast gold articles and massive pieces of jewelry for their family, as well as the insignia of officials.

Our own prospecting trips to these deposits in 1893 and 1894 yielded, merely by washing in a wash-trough and without amalgamation, "crude gold" which was clearly visible in the form of nuggets, grains and dust. Moreover, from natives who worked these deposits we acquired nuggets which were obtained by means of this same rudimentary process and which varied in weight from two to forty-five grams. We even saw nuggets of unrolled "or crespelé" weighing 140 and 225 grams, which came from the same place. What is more, it is not unusual to meet children wearing nuggets hung around their neck like amulets--nuggets which vary in volume from the size of a hazelnut to that of a pressed fig.

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The gentle slope and short length of the valleys where the deposits are found, and the proximity of the mountains from which the gold comes, are precious indications of the presence of outcropping lodes. Moreover, the appearance of the crespelé metal, as if it were spongy, [125] to which particles of quartz still adhere, is a confirmation of this hypothesis.

In 1895 a corporation called the "Mining and agricultural company of Laos" ["Société minière et agricole du Laos"], with a capital of 150,000 francs, was established in Paris through our efforts. It sent M. Ismard, a mining engineer, to the locality to study the deposits of gold and precious stones which we had prospected.

A corporation with a capital of several millions was later to take the place of the study group.

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The above engineer remained in the country for more than a year. He made a careful study of the deposits, and the report which he presented to the Company upon his return from his mission stated that we had been too modest in our estimates; that the gold-bearing deposits were of the first order, easily workable and almost at ground level. He concluded by proposing that a company with a very high capital be formed (1). Things seemed to be going well when an

(1) The content of these deposits varies from 3 to 14 grams of visible gold per ton of alluvia or of rich gravel.

event took place which reduced all our hopes to naught and rendered sterile the efforts of the Mining and agricultural company of Laos.

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Subsequent to a report by M, Mallet, an engineer sent by the government to prospect the region with which we are dealing, the governor general issued a decree dated February 16, 1896, stipulating that "possession and exploitation of gold-bearing mines or mines so reputed which are situated in the kingdom of Luang-Prabang on the left bank (between the Mekong and the Nam-Hou) may not be effected, until further notice, except by public tender."

This decree was not known in Laos until the engineer Isnard was actually on the spot. But it was justifiable to suppose that when confronted with the capital which had been collected, with that which had been offered, and with the work already done the government would invite tenders for the deposits.

Such was not at all the case. Today in 1900, it is still not the case!

The consequences may easily be guessed. Faced by this occurrence with the impossibility of doing anything at all, the Company abandoned the matter.

In the interest of Laos and of the finances of French Indo-China, we should like to express the wish (2) that the above-quoted decree be

(2) A proposal made by M.P. Macey before the 1900 Convention of Economic and Commercial Geography [Congrès de Géographie économique et commerciale de 1900].

abrogated and that the further notice of which mention is made be given within a short time so as to enable French capital to be put to good use in this part of our possession.

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In case our proposal should be accepted and the matter once more taken under consideration, we should advise that it be undertaken in the following way.

It would be well, especially in the beginning, to treat the gold-bearing alluvia by washing in a sluice and to extract the gold by amalgamation and cyanidation. The results would be sufficiently remunerative to make it possible, even while realizing profits, [126] to study and make ready for further exploitation of the lodes by means of more complete and more highly developed equipment. Such a procedure would, in our opinion, be wise, foresighted and of such a nature as to inspire a just confidence in capitalists. It would also enable them to advance in a sure fashion and with a well-founded hope of certain profits. Such profits, if held in reserve by prudent administrators, could not only provide sizeable dividends, but also go to increase the initial capital to any figure deemed necessary for exploitation at a later date of the deep-seated lode-bearing deposits.

The volume of these alluvial gold-bearing deposits may be estimated at approximately four million cubic meters, with an average weight of more than seven million tons.

They are all situated near that part of the Mekong which is navigable all year long by pirogues and rafts of from one to three tons, and in a reach which can be served by steam launches as far as Luang-Prabang during nearly five months of the year.

The countryside, moreover, is fairly well populated, offers sufficient resources in the way of food and contains a population which could provide more than a thousand specialized workers who have been accustomed since their childhood to treating gold-bearing alluvia (1).

(1) The study by M. Mallet shows us that all this part of the kingdom of Luang-Prabang is rich in gold. The gold extracted by the natives comes either from the sand of the river beds, from consolidated alluvia near the banks, or sometimes from hillside mines at a somewhat higher altitude, but never from direct treatment of the primitive rock, that is to say from gold-bearing quartz. The rock samples have always yielded amounts of gold which were insufficient to justify any attempt to treat them, but it would be entirely natural to try to work the consolidated alluvia. In the latter task, as M. Mallet's report proves, experienced miners could probably be recruited with ease "who would not be afraid to go down seven or eight meters and dig veritable mine

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galleries at this depth."

During this period of limited exploitation of the alluvia, which are quite rich, detailed studies could be made of the region in order to determine whether the gold content of the deep-seated rocks is really as slight as M. Mallet's summary explorations would seem to indicate. (Report by M. Courillon, head of the geological service of Indo-China.)

2. DEPOSITS OF VIEN-TIANE, NONG-KHAY

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That part of the territory of Vien-Tiane and Nong-Khay which is situated in the 25-kilometer restricted zone contains vast deposits of gold-bearing gravel which are deposited on the bottom of an immense basin about 5,000 square kilometers in area. The deposits are covered with a layer of more recent alluvia which varies from 7 to 12 meters in thickness.

The Mekong and its left and right bank tributaries called the Nam-Ngume, [127] the Nam-Tone, the Nam-Sang, the Nam-Soue and the Nam-Luong, now flow through this elliptical basin which straddles the intersection of the 100th meridian and the 18th parallel.

Between 1896 and 1898, after prospecting the deposits in the region of Nong-Khay, Tourakhome, Nam-Tone and Pone-Pinaye, we there noted the presence of the same bank of gold gravels at several points which were quite far apart.

Not until after discovering that they were currently being worked by the natives in several villages on the banks of the Mekong and in the upper part of its tributaries, did the idea occur to us to examine these deposits more closely.

These studies have been the object of several official reports in which we expressed the theory that two twin lake basins once existed on the two present banks of the Mekong, and that their bottoms would be covered by a sedimentary stratification of gold-bearing gravels about two meters in thickness.

According to one of our consuls in Siam, this hypothesis has been found to be correct by prospectors of various nationalities on the right bank of the Mekong, at several widely separated points both on the circumference and in the center of the lake basin. Supposing this to be true, our theory is thereby confirmed and the presence of gold noted under the conditions which we suggested.

The natives have for many years exploited the gold-bearing gravels on the Nam-Sang, the Nam-Tone, at Tourakhome and at

316 five points along the Mekong from Vien-Tiane to Pone-Pissaye (about 100 kilometers).

In the high valleys of the Nam-Sang and the Nam-Tone, the gold-bearing layer is covered only by a thin depth of sterile alluvia. At these points the gold content is quite high, and may be as much as nine to ten grams of visible crude gold per ton of rich gravel. The black schlich is scorned by the natives, and cast aside with the sand.

On the great river, in the places where by hollowing out its present bed through alluvia which have filled former lakes, the Mekong has laid bare the strata of gold-bearing gravels, the content of visible crude gold varies from eight to nine grams per ton of rich gravel. The points currently being worked are Phiea-Wait (Vien-Tiane), Ranhom and Ban-Sithane (between Vien-Tiane and Nong-Khay), and then Hatt-Kam-Noi and Hatt-Kam-Ngiai (between Nong-Khay and Pone-Pissaye).

To sum up: since this basin has an area of 5,000 square kilometers, if we suppose that the gold-bearing stratum covers only half of its bottom, the volume of gold gravels would be two and a half billion cubic meters, or about five million tons in weight.

The covering alluvia are made up of superposed beds of various rocks which were brought in suspension into the waters of the former lake and which were successively deposited at different periods, forming a quite compact sandy-clay mass in which mine galleries could be cut [128] without danger if wooden supports were used. The thickness of this layer varies, as we have noted, between seven and twelve meters.

As early as 1898 we directed the official attention of the technical committee of Indo-China to this interesting formation, the exploitation of which would, in our opinion, be a powerful vital element for Laos and a source of great budgetary profits.

3. DEPOSITS OF THE PROVINCE OF OUTHAI-THANI-SI-PAK-LAY

These deposits are situated on the right bank of the Mekong, in the kingdom of Luang-Prabang, 250 kilometers south-southwest of the capital.

Only a short distance from Pak-Lay, they occupy the valley of watercourses called the Nam-Sone and the Houei-Tani, which are tributaries of the Nam-Poun and have their source in the mountain

• 316 Pou-Khao-Tong.

The gold is found in fine gravel including miscellaneous rock debris which has been covered by the recent alluvia of the watercourses, at a depth varying from a few decimeters to a meter and a half.

In 1899, as samples resulting from trial prospecting, we provided the local organizing committee for the Exposition of 1900 with gold, with black schlichs, with untreated gold-bearing gravel and with superposed sterile alluvia.

The fifteen and a half grams (15-1/2 grams) of gold in the form of grains and dust which was supplied represented the supervised production of a single gold-washer, in visible gold, for thirty days work at the rate of 20 wash-troughs per day which weighed 3.5 kilograms each on the average.

The gold content of the black schlichs which resulted from the washing and which we collected can be determined only by analysis (1).

(1) They were sent for analysis to the Saigon laboratory, but the results have not yet been published.

On the average, a ton of treated gravel represented a weight of about 300 grams of black schlichs, and a volume of 118 cubic centimeters.

Thus, with the rudimentary methods used in this prospecting operation, without amalgamation and despite the inevitable losses, the fifteen and a half grams of gold collected, using local procedures and labor, cost 30 francs, or 1.935 francs per gram and 1,935 francs per kilogram (2).

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(2) Here, by way of comparison, are the cost prices of gold at several points of the globe:

Saint-Elie (French Guiana), 1619 francs
Siberia 2170 francs
California, 1500 to 1700 francs
Australia, 1600 to 1900 francs

This, of course, by using the most advanced methods which reduce losses of the precious metal to almost nothing.

The respective densities of the schlichs, of the gold-bearing gravels and of the sterile alluvia [129] were 2.6 for the schlichs, 1.82 for the gravels and 1.49 for the sterile alluvia.

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It should be noted that the various points of the deposits where prospecting operations were carried out were chosen arbitrarily and at random. We are therefore justified in supposing that the average everywhere would remain close to what we have noted. Moreover, the extent of the Nam-Some and Houei-Tani deposits which, in their known parts, stretch over a length of about 30 kilometers, may be estimated at nearly two million cubic meters of rich gravel, or a weight of three million tons. The volume of sterile alluvia which would have to be removed in order to reach the rich gravels would be about three million cubic meters.

It should now be stated that, in our opinion, these deposits do not require the establishment of powerful corporations for their exploitation. On the contrary, the most suitable arrangement here, given the general appearance of the whole length of the deposits and the obligatory division into small holdings as specified by the decree governing mines, would be small groupings of capital in amounts of 100,000 or 200,000 francs, which would work simultaneously side by side.

It is to be hoped that these lines will come to the attention of persons interested in this question, and will decide them to exploit deposits which are located in proximity to the Mekong, in a region which is sufficiently populous and offers highly varied resources.

4. DEPOSITS OF MUONG-SON (HUA-PHAN-HA-TANG-HOC)

These deposits, known as "Muong-Son" deposits, occupy the upper valley of the Nam-Het, a right-bank tributary of the Nam-Ma (or Song-Ma) which itself flows into the Gulf of Tonkin. They are situated in the province of Hua-Phan-Ha-Tang-Hoc, which forms a part of Laos and borders on both Tonkin and Annam.

The Nam-Het flows in an erosion valley where calcareous masses, which have remained standing and which support hills of hard schists, form a succession of more or less elongated cirques at whose points of junction the channel is greatly constricted.

This arrangement "like a string of beads" constitutes a succession of terraced valleys which are from four to ten kilometers long and 800 to 1500 meters wide, and which are highly favorable to alluvial deposits. The gold-bearing rocks come from peaks more than 2,000 meters high called Pou-Luong and Pou-Loi, and have been disaggregated, carried into the valleys and reduced to small fragments from which the metallic particles have been released. By reason of

• 3/6 their greater density, and thanks to the eddy currents caused by the constricted parts of the valleys, these precious particles have been deposited on the bed rock amidst rolled stones, gravel and sand.

[130] It is there, under a thin layer of sterile alluvia which does not exceed two meters in depth and the surface of which is entirely covered by ricefields, that gold can be found in the form of nuggets and grains.

With a view toward satisfying requests for information on the part of the Geological Service of Indo-China, we were led to investigate:

1. The plausibility of the presence of gold in the region through an examination of the formations of the peaks from which the gold came;

2. Having acknowledged the plausibility thereof, to prospect the valleys in order to discover whether gold were really present there. Our predictions were crowned with success, since excavations in the midst of ricefields, at points chosen almost absolutely at random and without any outer indications, yielded visible crude gold merely through washing in a wash-trough and without amalgamation with mercury, to the great astonishment of the natives and, it must be said, of some Europeans.

According to the methodical and supervised prospecting operations which we carried out, the layer of sterile alluvia covering the gold-bearing stratum is from 1.5 to 2.5 meters in depth and is made up of matter which is easy to work by mere manual digging with spade and pick.

The visible crude gold content per ton of rich alluvia would be, on the average, three and a half grams.

The black schlichs resulting from the washing operations are numerous and high in density, but the Laboratory of Saigon to which they were sent has not yet made known the results of its analysis. Plentiful and heavy, they ought also to contain quite a large amount of pure gold.

The valleys like beads on a string which may contain gold-bearing alluvia extend over more than half of the course of the Nam-Het, that is to say over about sixty kilometers. Given the average breadth of the valleys and the thickness of the gold-bearing stratum, its volume and weight may be estimated, respectively at fifty million cubic meters and from seventy-five to eighty million tons.

A more complete study of these deposits and their exploitation would be undertakings worth trying. The climate of the region is very

316 healthy, and labor could be found quite easily. The route of access to the territory of Muong-Son would be through Tonkin, either by way of Cho-Bo-Van-Bu-Muong-Het or by way of Cho-Bo-Ta-Koa-Muong-Het. The journey from Hanoi to Muong-Son can be made in fifteen to eighteen days, as follows: two by steamship, eight by pirogue and the rest on horseback with bearers for the baggage.

(Extract from the reports by M. P. Macey.)

[131]

APPENDIX XXII
NOTES ON RUBBER
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314 In Laos, the rubber lianas are known to the natives by the generic name Khua (1). According to the information which M.

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(1) In Laotian, khua is a generic term applied to all lianas and to all climbing plants without exception.

Leblévec, head of the Upper Mekong Hydrographic Mission, was so kind to furnish me upon my request, their number seems to be quite large.

This traveler classifies the rubber lianas of Upper Laos into two categories, according to the nature of the product which they yield.

The first category includes the Khua-ka-tong-ka-tiou, the Khua-sout-long and the Khua-som-lam. The elastic gum which these varieties produce is dark in color, either black or chestnut. The bark is pebbly and blackish-green in color. The leaves are shiny and dark green. The fruit is elongated and produces pilose, barbed seeds. Some of these lianas are as much as 30 to 40 centimeters in circumference. They are found in the forests of the Laotian plains, on the banks of the Mekong.

The Ka-tong-ka-tiou is said to be found nearly everywhere on very humid terrain covered with rushes which are burned in the rainy season. The Sout-long is found on the banks of the Ngoum, in the region of Tourakom. The Som-lam grows on the upper Nam-Sam and in Xieng-Khouang.

M. Leblévec classifies the lianas which yield a light brown or dark reddish rubber in the second category. These are the Khua-mac-ka-khay, the Khua-kao-pong, the Khua-lam-sai and the Khua-tang-tong.